

Health Consultation

Engineering Evaluation/Cost Analysis

BONNE TERRE MINE TAILINGS

BONNE TERRE, ST. FRANCOIS COUNTY, MISSOURI

CERCLIS NO. MOD985818236

NOVEMBER 18, 1998

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Prepared by:

**Missouri Department of Health
Section of Environmental Health
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry**

STATEMENT OF ISSUES

The Environmental Protection Agency (EPA) has determined that a non-time-critical removal action is required on the Bonne Terre Mine Tailings site because the lead in the tailings presents a threat of actual or potential exposure to nearby communities. An engineering evaluation/cost analysis (EE/CA) was completed to determine the different approaches that were available for site remediation. This health consultation, prepared at the request of EPA, will evaluate the selected alternatives to determine if they are protective of public health.

BACKGROUND

The Bonne Terre Mine Tailings Site is one of the six major tailings piles left from nearly 100 years of mining operations and stockpiling of lead mining waste that make up the Old Lead Belt of St. Francois County in southeastern Missouri. The site is located in and on the eastern outskirts of the City of Bonne Terre, St. Francois County, Missouri. Bonne Terre is located approximately 70 miles south of St. Louis, Missouri. For the EPA-requested engineering evaluation/cost analysis (EE/CA), the site has been divided into three discrete areas:

1. the east tailings pond area (Area A) is east of U.S. Highway 67 and consists of approximately 160 acres;
2. the intermediate tailings/chat area (Area B) located between old U.S. Highway 67 and U.S. Highway 67, consisting of at least 23 acres of patchy tailings and chat deposits; and,
3. the chat pile and tailings field (Area C) consists of an approximately 170-foot-high chat pile (from the road on the west) that covers 32 acres, an adjoining 14 acres of tailings/erosional field, and areas of visible chat and tailings surrounding these areas (See Figure 1) (1).

The EE/CA refers to the mine waste as chat and tailings in the various areas. Because the waste materials vary from powder to large sand-sized particles, this document will refer to all the materials as tailings. The difference between the chat and tailings material is that chat is a fine to coarse dolomite (a form of limestone) produced during the early milling process that used density separation. Chat was transported mechanically by conveyor and deposited in large piles. Tailings were produced in the later years using a wet chemical process and are typically smaller fragments than chat. The tailings were hydraulically deposited into impoundments known as tailings ponds (2). The erosional fields consist of the smallest sized materials (powder size).

Surface mining was conducted in the Bonne Terre area prior to 1820. The St. Joseph Lead Company was organized in 1864 and began mining operations at Bonne Terre in 1865.

Introduction of diamond drill prospecting in 1869, allowed the discovery of disseminated ore at depth. Operations ceased at the Bonne Terre site with the permanent closing of the mill in 1961 (2).

The tailings pile and associated erosional field (Area C) are located in the City of Bonne Terre north of Benham Street and west of Hazel Street. The tailings pile is surrounded on the west and south with residential and commercial areas, including the North St. Francois County elementary school. Between the tailings pile and school are fenced playing fields for the school, an old railroad track bed used as an access road, and a yard waste recycling area. The areas north of the tailings pile are less developed, but include various commercial and residential properties, a golf course, and a cemetery. The intermediate tailings area (Area B) has numerous commercial and residential properties and is separated from the east tailings pond (Area A) on the east by U.S. Highway 67. The east tailings pond (Area A) includes various residential and commercial properties mostly on the south and eastern borders (See Figure 1). On the east side of the tailings pond is a portion of the area used for a sand drag-racing track which has been in operation since 1990. Recent development has taken place on the southern portion of the tailings pond (1,3).

The population of the city of Bonne Terre, according to 1990 U.S. Census Data, is 3,871, with 99.4% being white. Of the population, 10.2% are six years and younger and 17% are 65 and older (4).

Contaminants found in various locations in the Bonne Terre tailings include the following, in parts per million (ppm) (2,5):

Range of Metal Contamination in Bonne Terre Mine Tailings (88 samples (1983))		
Lead	Cadmium	Zinc
1,300 - 7,010	3 - 29.5	51.3 - 967

As part of the EE/CA, soil borings were taken to determine the depth and physical characteristics of the tailings. Samples were also taken to determine the amount of metal contamination from the Community Services Property (north of the tailings pile) and from the intermediate tailings area. Results of the March 1998 sampling, in milligrams per kilogram (mg/kg) (1), are listed below (Note: mg/kg = ppm):

Range of Metal Contamination from EE/CA Sampling (15 samples (1998))		
Lead	Cadmium	Zinc
198 - 3,390	less than 0.64 - 6.6	35 - 286

The surfaces of the tailings are bare or have limited vegetation and are exposed to the natural elements where wind and rain can transport them throughout the area. Access to the tailings areas are mostly unrestricted with the exception of some of the privately owned properties. The tailings are sometimes used by off-road vehicles for recreation activities, especially in the east tailings area where sand drag races are held (1).

DISCUSSION

Lead at levels of up to 7,010 parts per million (ppm) are present in the mine tailings that are situated within and adjacent to the City of Bonne Terre. This is above the Missouri Department of Health's (DOH) Any-Use Soil Level (ASL) for lead (240 ppm). An ASL is a health-based value that represents the maximum concentration of a chemical that will be acceptable in the soil, regardless of future land use.

This level of lead can pose a health hazard to children and developing fetuses who are especially vulnerable to the toxic effects of lead. They are also more likely to ingest lead-contaminated dust because of their high hand to mouth activity. Children exposed to lead have shown adverse health effects on the central nervous system, kidney, and hematopoietic system, as well as decreased intelligence and impaired neurobehavioral development (6).

Maximum levels of cadmium and zinc in the Bonne Terre tailings were 29.5 ppm and 967 ppm respectively. This is approximately equal to the Agency for Toxic Substances and Disease Registry's (ATSDR) comparison value for cadmium (28 ppm) for a child and above the comparison value (600 ppm) for zinc for a pica child. Levels below a comparison value are unlikely to pose a health threat. These levels should not pose a health problem except to a pica child. Pica is a medical condition in children that exhibit a greater-than-normal hand-to-mouth behavior.

The contaminated tailings are exposed to the environment where direct human exposure can take place with activities on site. Exposure can be from inhalation or incidental ingestion of the contaminated dust or tailings.

The tailings are also readily moved off site by wind and rain, where they pose further exposure pathways to the residents of Bonne Terre. The lead-contaminated particles are transported off site where they can be inhaled from the ambient air or incidental ingestion can occur when the contaminated dust settles in homes or on items that are ingested. The tailings can also be moved off site by wind and water erosion to migrate to surface water or settle on surface soils (e.g. yards) where they can also pose an exposure pathway. An example of the exposure pathways potentially affecting the most vulnerable population (children) is the North St. Francois County Elementary School and its playing fields located approximately 1,500 feet from the tailings pile (Area C).

To eliminate the exposure pathways from the contaminated tailings, an engineering evaluation/cost analysis (EE/CA) was completed to select alternatives for controlling wind erosion and storm water runoff along with providing slope stabilization. Of the different possible methods to manage and control the tailings, a number of possible alternatives are chosen. From the range of different alternatives, selected alternatives are chosen which are the best balance of the advantages of each alternative with potential disadvantages. These alternatives also provide the greatest overall protection of human health and the environment over the long term without excessive cost.

In the EE/CA, remedial alternatives have been selected for each of the three areas. For all three areas, administrative controls would provide for deed restrictions on the undeveloped and developed properties, signs would be posted to inhibit trespassing and tailings removal, and air and surface water would be monitored (1).

Undeveloped portions of the reality flat east tailings pond (Area A), will be vegetated. What slopes are present will be lowered to at least a slope of three feet horizontal for every one foot vertical (3H:1V). These 3H:1V slopes will be covered with riprap (larger rocks), while the area near the center of the site will be graded to a lesser slope (5H:1V) and vegetated. The two existing settling ponds will be maintained to catch storm water runoff from the tailings area. The area is expected to be used for commercial development after remediation (1).

The intermediate area (Area B) will have the existing steep slope regraded to a 3H:1V and covered with riprap or topsoil and vegetation. An existing depression that presently collects storm water will be regraded to a permanent ponding area by adding a controlled outlet (1).

The selected alternative for the tailings pile and field (Area C) is to lower the elevation of the tailings pile by moving some of the material to the tailings/erosion field and associated areas. This will leave the top of the pile as a relatively flat area that will be suitable for commercial development. Access roads will be provided and the top of the pile will be vegetated and the slopes (3H:1V) covered with riprap or topsoil and vegetation. The entire area will drain to a sedimentation pond (1).

Child Health Considerations

Children are the most likely age group for adverse health effects from the lead contamination at the Bonne Terre Mine Tailings site and were considered when evaluating the selected alternatives. Lead contamination that leaves the site provides a pathway of exposure to children. Children may also be exposed on site. The most likely pathway for children is airborne contaminated dust that settles inside homes or other areas where children are present and is ingested by their high hand-to-mouth activity. Children and fetuses are especially vulnerable to the toxic effects of lead. Children exposed to lead have shown adverse health effects on the central nervous system,

kidney, and hematopoietic system, as well as decreased intelligence and impaired neurobehavioral development.

CONCLUSIONS

From the information provided, the Missouri Department of Health (DOH) concludes that the selected alternatives from the EE/CA on the Bonne Terre Mine Tailings site should be protective of public health when completed properly. The selected alternatives should provide the stabilization needed to prevent the tailings from leaving the site and posing exposure pathways as well as preventing exposure pathways on site. They should also provide development potential to an area that once was unusable.

1. The selected alternatives from the EE/CA, if performed properly, should stabilize the tailings and prevent future exposure pathways as well as allow use of the property that is presently unusable.
2. Lead is present in the Bonne Terre tailings above a level of public health concern. The tailings are exposed to the environment where they provide exposure pathways to residents of Bonne Terre both on and off site.

RECOMMENDATIONS

1. Complete the stabilization process of selected alternatives as described in the EE/CA.
2. Provide that the administrative controls listed in the EE/CA apply to all three areas of the Bonne Terre tailings.
3. Ensure that vegetative cover is established and maintained to prevent contact with the tailings.
4. Ensure that measures are taken to prevent exposure at commercial properties where special consideration must be given to prevent exposure (e.g. day care centers).
5. Ensure that the holding ponds will not become a source of dust generation, especially in dry seasons.

The Missouri Department of Health will review additional information when it becomes available.

Preparers of Report:

Arthur Busch, Scott Clardy, Brian Quinn, Missouri Department of Health

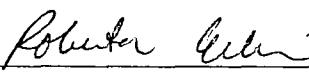
Attachment: Figure 1: Bonne Terre Mine Tailings Site Location Map

REFERENCES

1. Barr Engineering Company. Engineering Evaluation/Cost Analysis, Bonne Terre Mine Tailings Site, Bonne Terre, Missouri. June 1998.
2. Fluor Daniel Environmental Services. Draft Initial Remedial Investigation, Big River Mine Tailings Site, Old Lead Belt, St. Francois County, Missouri. April 1995.
3. Site visit of Bonne Terre. June 17, 1998.
4. Missouri State Census Data Center. 1990 Census of Population and Housing, Bonne Terre, Missouri. Summary Tape File 1, 8 page profile. 1991.
5. Agency for Toxic Substances and Disease Registry. Preliminary Public Health Assessment for the Big River Mine Tailings, Desloge. Atlanta: ATSDR, August 14, 1996.
6. Center for Disease Control. Preventing Lead Poisoning in Young Children. Atlanta: CDC, DHHS Publication. 1991.

CERTIFICATION

The Bonne Terre Mine Tailings Site Health Consultation was prepared by the Missouri Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was initiated.



Technical Project Officer, SPS, SSAB, DHAC

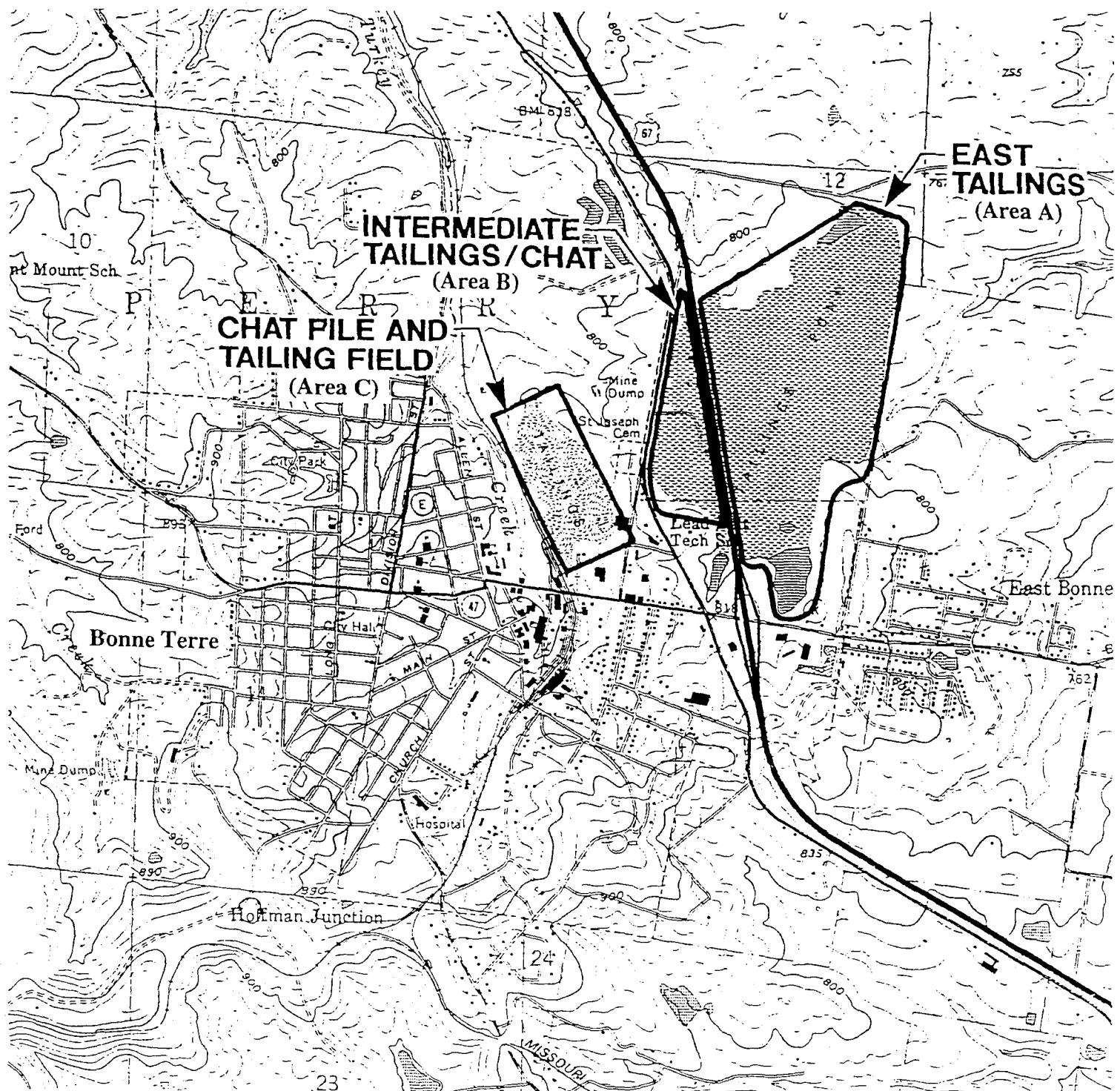
The Superfund Site Assessment Branch of the Division of Health Assessment and Consultation, ATSDR, has reviewed this Health Consultation and concurs with its findings.



Chief, SPS, SSAB, DHAC

Figure 1

Bonne Terre Mine Tailings Site Location Map



Source: Engineering Evaluation/Cost Analysis,
Bonne Terre Mine Tailings. June 1998

0 2000 4000
Scale in Feet

